

CAVITY CASE WITH CLIP/PLUG FOR USE ON MULTI-MEDIA CARD

INVENTOR

Maximilien d'Estries

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT RE: FEDERALLY SPONSORED RESEARCH/DEVELOPMENT

[0002] Not Applicable

BACKGROUND OF THE INVENTION

[0003] The present invention relates generally to memory cards and, more particularly, to memory, game memory, and I/O cards which are fabricated through the use of an injection molded case alone or in combination with either a spring clip or a spacer.

[0004] As is well known in the electronics industry, memory cards and I/O cards are being used in increasing numbers to provide memory storage and other electronic functions for devices such as digital cameras, MP3 players, cellular phones, personal digital assistants, and hand-held video games. In this regard, memory cards are provided in various formats, including multi-media cards and secure digital cards.

[0005] Typically, memory cards and I/O cards comprise multiple integrated circuit devices or semiconductor dies. The semiconductor dies are interconnected using a circuit board substrate which adds to the weight, thickness, stiffness and complexity of the card. Memory cards and I/O cards also include electrical contacts for providing an external interface to an insertion point or socket. These electrical contacts are typically disposed on the backside of the circuit board substrate, with the electrical connection to the dies being provided by vias which extend through the circuit board substrate.

[0006] In an effort to simplify the process steps needed to fabricate the memory card, there has been developed by Applicant a memory card wherein a leadframe assembly is used as an alternative to the circuit board substrate. In this particular memory card, the leadframe and semiconductor die of the memory card are covered with an encapsulant which hardens into a cover or body of the memory card. The body is sized and configured to meet or achieve a "form factor" for the memory card. In the completed memory card, the contacts of the leadframe are exposed within a common surface of the body, with the die pad of the leadframe and the semiconductor die mounted thereto being disposed within or covered by the body.

[0007] The present invention provides a further, alternative simplified manufacturing process for a memory card or I/O card which employs the use of an injection molded case into which a substrate such as a lan grid array substrate is advanced. The substrate is anchored or maintained within the interior of the case through either the use of an adhesive, the use of an adhesive in conjunction with a spacer or plug, or the use of a spring clip without any adhesive, depending on the size of the substrate. These and other features of the present invention will be described in more detail below.

BRIEF SUMMARY OF THE INVENTION

[0008] In accordance with the present invention, there is provided a card such as a memory card, game memory card or I/O card which is assembled through the advancement of a substrate such as a lan grid array substrate into a case. The case is preferably a unitary structure which may be fabricated through the completion of an injection molding process. The case includes opposed, generally planar sides, a closed end, and an open end which provides access into an interior chamber collectively defined by the closed end and the opposed sides. Disposed within one of the sides of the cover is an aperture or window which communicates with the interior chamber. The substrate, which includes a plurality of terminals or contacts, is advanced into the interior chamber via the open end of the case. When the substrate is properly inserted into the case, the terminals or contacts are exposed within the window of the case.

[0009] In accordance with one embodiment of the present invention, the substrate is mounted or maintained in a prescribed position in the interior chamber of the case via a spring clip which is itself advanced into the interior chamber. The spring clip is cooperatively engageable to both the case and the substrate. In another embodiment of the present invention, the spring clip is

substituted with a spacer which is itself advanced into the interior chamber of the case and cooperatively engaged to the substrate already inserted therein. Both the substrate and the spacer are mounted to the case through the use of an adhesive. In yet another embodiment of the present invention, both the spring clip and the spacer are completely eliminated, with the substrate being advanced into the interior chamber of the case and mounted to the case through the use of an adhesive. The elimination of the spring clip or spacer occurs when the size and configuration of the substrate closely mirrors that of the interior chamber.

[0010] The present invention is best understood by reference to the following detailed description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] These, as well as other features of the present invention, will become more apparent upon reference to the drawings wherein:

[0012] Figure 1 is a top perspective view of a card constructed in accordance with a first embodiment of the present invention;

[0013] Figure 2 is an enlargement of the encircled region 2 shown in Figure 1;

[0014] Figure 3 is a bottom perspective view of the card of the first embodiment;

[0015] Figure 4 is a top plan view of the case of the card of the first embodiment;

[0016] Figure 5 is a top plan view of the spring clip of the card of the first embodiment;

[0017] Figure 6 is a bottom plan view of the card of the first embodiment;

[0018] Figures 7A-7C illustrate an exemplary sequence of steps by which the card of the first embodiment may be assembled;

[0019] Figure 8 is an exploded view of a card constructed in accordance with a second embodiment of the present invention;

[0020] Figure 9 is a top plan view of the case of the card of the second embodiment; and

[0021] Figure 10 is an exploded view of a card constructed in accordance with a third embodiment of the present invention.

[0022] Common reference numerals are used throughout the drawings and detailed description to indicate like elements.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Referring now to the drawings wherein the showings are for purposes of illustrating preferred embodiments of the present invention only, and not for purposes of limiting the same, Figures 1 and 3 provide top and bottom perspective views, respectively, of a card 10 constructed in accordance with a first embodiment of the present invention. The card 10 may be a memory card, a game memory card, an I/O card, or any other type of multi-media card. The card 10 comprises a case 12 which, as best seen in Figures 1, 3 and 6 has a generally planar first (top) side 14 and an opposed, generally planar second (bottom) side 16. In addition to the first and second sides 14, 16, the case 12 includes a closed first end 18 and an opposed, open second end 20. The first and second sides 14, 16 and closed first end 18 collectively define an interior chamber 22 of the case 12 which is best seen in Figure 4. Disposed within the first side 14 of the case 12 is an elongate slot 24 which extends along a portion of the open second end 20 and communicates with the interior chamber 22. Additionally, disposed within the second side 16 of the case 12 is a generally quadrangular aperture or window 26 which itself communicates with the interior chamber 22. The window 26 is disposed in close proximity to closed first end 18 of the case 12. The use of both the slot 24 and window 26 will be discussed in more detail below.

[0024] As is best seen in Figure 4, the interior chamber 22 of the case 12 has a tapered configuration. In the case 22, the first and second ends 18, 20 extend in spaced, generally parallel relation to each other. In addition to being partially defined by the first and second sides 14, 16 and closed first end 18, the interior chamber 22 is also partially defined by an opposed pair of side walls 28 of the case 12. Each of the side walls 28 has a first section which extends non-perpendicularly from the second end 20 and transitions to a second section which extends perpendicularly to the first end 18. In this regard, the first sections of the side walls 28 are inwardly sloped or tapered such that the distance separating the first sections gradually decreases as they extend from the second end 20 to the second sections. Since the second section of each side wall 28 extends generally perpendicularly relative to the first end 18 of the case 12, the distance separating the second sections of the side walls 28 from each other is substantially constant. The length of the second section of each side wall 28 is substantially equal to the width of the window 26 disposed within the second side 16 of the case 12.

[0025] In the case 12 of the card 10, disposed within the sloped first section of each side wall 28 is a cavity or notch 30. Notches 30, which each communicate with the interior chamber 22, are preferably oriented in opposed relation to each other. As Shown in Figure 4, the notches 30 are positioned at approximately the centers of respective ones of the first sections of the side walls 28. However, as will be discussed in more detail below, each notch 30 may be positioned anywhere along the length of the first section of a respective side wall 28, depending on the size of other components which are interfaced to the case 12 to facilitate the assembly of the card 10.

[0026] In the card 10, it is contemplated that the case 12 will be fabricated as a unitary structure through the completion of an injection molding process. During such molding process, the interior chamber 22 is created as a result of the advancement of an elongate tongue or projection into the interior of the mold cavity which ultimately forms the case 12. The tongue or projection has a tapered configuration to assist in its removal from the fully formed case, such tapered configuration of the tongue or projection facilitating the resultant tapered configuration of the interior chamber 22 as described above. It is further contemplated that the case 12 will be fabricated from a suitable plastic material.

[0027] In addition to the case 12, the card 10 of the first embodiment comprises a substrate 32. The substrate 32 has a generally quadrangular configuration, and includes a plurality of elongate, conductive contacts or terminals 34 extending in spaced, generally parallel relation to each other on a common side thereof. The substrate 32 defines an opposed pair of first sides 36 and an opposed pair of second sides 38. The distance separating the second sides 38 of the substrate 32 from each other is substantially equal to, but slightly less than, the distance separating the spaced, generally parallel second sections of the side walls 28 from each other. Embedded within the substrate 32 is one or more semiconductor dies alone or in combination with one or more other passive electrical devices, the semiconductor die(s) and passive device(s) (if any) being electrically connected to the terminals 34 exposed in the common side of the substrate 32 in any desired pattern or arrangement. In the card 10, it is contemplated that the substrate 32 may comprise a lan grid array substrate.

[0028] In assembling the card 10, the substrate 32 is advanced into the interior chamber 22 of the case 12 via the open second end 20 thereof. Such advancement is continued until such time as one first side 36 of the substrate 32 is abutted against the closed first end 18 of the case 12. The substrate 32 and case 12 are sized and configured relative to each other such that the

terminals 34 are placeable into registry with the window 26 when the substrate 32 is fully advanced into the interior chamber 22, i.e., the first side 36 of the substrate 32 disposed closest to the terminals 34 is abutted against the closed first end 18 of the case 12. Thus, the terminals 34 are completely exposed within the window 26 of the case 12 when the substrate 32 is fully, properly inserted into the interior chamber 22 of the case 12.

[0029] Referring now to Figures 5 and 6, the card 10 of the first embodiment further comprises a spring clip 40 which is also advanced into the interior chamber 22 of the case 12, and is sized and configured to cooperatively engage the substrate 32 in a manner maintaining the substrate 32 in a prescribed position within the interior chamber 22, and more particularly the position whereat the terminals 34 are exposed within the window 26 of the case 12. The spring clip 40 comprises a main body 42. Integrally connected to and extending from the main body 42 in opposed relation to each other is a pair of elongate, resilient engagement arms 44. Integrally connected to and projecting laterally outwardly from the distal end of each engagement arm 44 is a locking tab 46. In addition to the engagement arms 44, also integrally connected to and extending from the main body 42 is a resilient biasing member 48 which has a generally V-shaped configuration. Formed on the main body 42 and extending partially along the edge thereof disposed furthest from the biasing member 48 is a nail edge portion 50. As best seen in Figure 5, the engagement arms 44 of the spring clip 40 do not extend in parallel relation to each other, but rather are formed to have a slight outward flare.

[0030] In assembling the card 10, the spring clip 40 is advanced into the interior chamber 22 of the case 12 biasing member 48 first subsequent to the advancement of the substrate 32 into the interior chamber 22 in the above-described manner. As the spring clip 40 is advanced into the interior chamber 22, the eventual engagement of the rounded surfaces of the locking tabs 46 to respective ones of the sloped first sections of the side walls 28 facilitates the inward flexion of the engagement arms 44 as the locking tabs 46 thereof continue to travel along the first sections of the side walls 28. When the locking tabs 46 come to the notches 30 within the first sections of the side walls 28, the resultant outward flexion of the engagement arms 44 to their original, unflexed position facilitates the insertion of the locking tabs 46 into respective ones of the notches 30. Prior to the locking tabs 46 reaching the notches 30, the distal leg or prong of the biasing member 48 engages the first side 36 of the substrate 32 disposed furthest from the first end 18 of the case 12. Subsequent to the engagement of such prong or arm to the corresponding

first side 36 of the substrate 32, the continued advancement of the spring clip 40 into the interior chamber 22 facilitates the compression of the distal prong of the biasing member 48 toward the remaining prong, and resultant application of an outward biasing force to the substrate 32 as effectively maintains the same in firm engagement to the closed first end 18 of the case 12. As will be recognized, the compressive pressure exerted by the spring clip 40 against the substrate 32 is maintained as a result of the attachment of the spring clip 40 to the case 12 as occurs when the locking tabs 46 of the engagement arms 44 are inserted into respective ones of the notches 30 in the above-described manner.

[0031] As will be recognized, the case 12, spring clip 40, and substrate 32 are sized and configured relative to each other such that the compression of the prongs of the biasing member 48 and hence the application of biasing force to the substrate 32 occurs prior to the insertion of the locking tabs 46 of the engagement arms 44 into the notches 30 of the case 12. When the spring clip 40 is fully inserted into the interior chamber 22 and engaged to the case 12, the main body 42 of the spring clip 40 does not protrude beyond the open second end 20 of the case 12. However, the nail edge portion 50 formed on the main body 42 is exposed in the slot 24 of the case 12, as is best shown in Figures 1, 2 and 6. As is also seen in Figure 6, the outermost side edges 52 of the main body 42 of the spring clip 40 each have tapers which are complimentary to those of the first sections of the side walls 28, thus facilitating firm engagement between the side edges 52 and side walls 28 when the spring clip 40 is fully inserted into the interior chamber 22.

[0032] Those of ordinary skill in the art will recognize that the size of the spring clip 40 as shown in Figures 4 and 6 is exemplary only, in that such size may be varied according to the size of the substrate 32. For example, if a substrate larger than the substrate 32 (i.e., of increased length between the sided 36) is to be inserted into the case 12, the size of the corresponding spring clip 40 would be smaller. More particularly, the length of the main body 42 of such alternative spring clip 40 between the nail edge portion 50 and biasing member 48 would be shorter, as would the lengths of the engagement arms 44 of such alternative spring clip 40. As a result of the reduced length of the engagement arms 44, the case 12 which would accommodate such alternative spring clip 40 would also have a configuration differing from that of the case 12 shown in Figures 4 and 6. More particularly, the location of the notches 30 in such alternative case 12 would be more toward the second end 20 to correspond to the reduced lengths of the engagement arms 44 in the alternative spring clip 40. Along these same lines, the notches 30

may also be formed in the case 12 to be closer to the first end 18 of the case 12 as compared to the locations of the notches 30 shown in Figures 4 and 6 in the event a spring clip 40 larger than that shown in Figures 5 and 6 is used in conjunction with a substrate having a length which is less than that of the length of the substrate 32.

[0033] Figures 7A, 7B and 7C illustrate the sequence of steps which is preferably used to facilitate the assembly of the card 10. In the initial stage of such assembly, the substrate 32 is advanced into the interior chamber 22 of the case 12 in the above-described manner. Subsequent to the full insertion of the substrate 32 into the interior chamber 22 such that the terminals 34 are exposed in the window 26, the spring clip 40 is fully inserted into the interior chamber 22 in the above-described manner. In the fully assembled card 10, the exposure of the nail edge portion 50 of the spring clip 40 in the notch 30 of the case 12 is used to provide a grip which assists in the removal of the card 10 from a host socket.

[0034] Referring now to Figure 8, there is shown a card 54 constructed in accordance with a second embodiment of the present invention. The card 54 itself includes a case 12a which is shown in Figure 9. The case 12a is substantially similar in configuration to the above-described case 12, with the sole distinction being that the case 12a does not include the above-described notches 30. A further distinction between the card 54 and the card 10 lies in the substitution of the spring clip 40 of the card 10 with a plug or spacer 56 in the card 54. In addition to the case 12a and spacer 56, the card 54 includes a substrate 32a which is analogous to the substrate 32 described above in relation to the card 10.

[0035] In assembling the card 54, the substrate 32a is inserted into the interior chamber 22a of the case 12a in the same manner described above in relation to the insertion of the substrate 32 into the case 12 in the card 10. However, in the card 54, the substrate 32a is rigidly mounted to the case 12a to maintain the substrate 32a in the proper position within the interior chamber 22a. The mounting of the substrate 32a to the case 12a is preferably accomplished through the use of an adhesive. Such adhesive may be pre-applied to the substrate 32a prior to the advancement thereof into the interior chamber 22a of the case 12a, or may alternatively be injected into the interior chamber 22a prior to the advancement of the substrate 32a thereinto. Contemplated adhesives include a pressure sensitive film and a B-staged material which reflows a temperature but is solid at room temperature.

[0036] Subsequent to the substrate 32a being inserted into the interior chamber 22a and mounted to the case 12a in the above-described manner, the spacer 56 is then advanced into the interior chamber 22a of the case 12a. The spacer 56 is sized and configured to fill the space within the interior chamber 22a which is defined between the open second end 20a of the case 12a and the first side 36a of the substrate 32a which is disposed furthest from the closed first end 18a of the case 12a. Like the substrate 32a, the spacer 56 is mounted to the case 12a through the use of an adhesive which is either pre-applied to the spacer 56 or injected into the interior chamber 22a. The spacer 56 is further preferably sized such that when advanced into the interior chamber 22a and secured to the case 12a, no portion of the spacer 56 protrudes beyond the second end 20a of the case 12a. Though not shown, the spacer 56 may optionally be provided with a nail edge portion similar to the nail edge portion 50 shown and described above in relation to the spring clip 40, such nail edge portion of the spacer 56 being exposed in the notch 30a of the case 12a when the spacer 56 is advanced into the interior chamber 22a and secured to the case 12a. Such nail edge portion of the spacer 56 would also be used to assist in the removal of the card 54 from a host socket. Those of ordinary skill in the art will recognize that the size of the spacer 56 may be varied as needed to correspond to the size of the substrate 32a.

[0037] Referring now to Figure 10, there is shown a card 58 constructed in accordance with a third embodiment of the present invention. The card 58 includes a case 12b which is identically configured to the case 12a of the card 54 of the second embodiment. The distinction between the card 58 and the card 54 lies in the omission of the spacer 56 from the card 58. In this regard, the spacer 56 is omitted as a result of the increased size of the substrate 32b in the card 58 in comparison to the size of the substrate 32a of the card 54 and the substrate 32 of the card 10.

[0038] In the card 58, the substrate 32b is fully advanced into the interior chamber of the case 12b such that the first side 36b disposed closest to the terminals of the substrate 32b is abutted against the first end 18b of the case 12b. The case 12b and substrate 32b are preferably sized relative to each other such that the remaining, opposed first side 36b of the substrate 32b extends to but does not protrude beyond the second end 20b of the case 12b. Like the substrate 32a, the substrate 32b is preferably mounted to the case 12b through the use of an adhesive which is either pre-applied to the substrate 32b, or pre-applied to the interior of the case 12b. It is contemplated that any fill/pot draft space defined between the case 12b and the substrate 32b subsequent to the advancement of the substrate 32b into the interior chamber of the case 12b may

be filled with adhesive. Those of ordinary skill in the art will recognize that the size of the case 12b may be varied as is needed to accommodate the length of the substrate 32b. Similarly, the size of the spacer 56 may be varied as needed to correspond to the size of the substrate 32a.

[0039] This disclosure provides exemplary embodiments of the present invention. The scope of the present invention is not limited by these exemplary embodiments. Numerous variations, whether explicitly provided for by the specification or implied by the specification, such as variations in structure, dimension, type of material and manufacturing process may be implemented by one of skill in the art in view of this disclosure.